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USING TYPE Ia SUPERNOVAE AS EARMARKS FOR LOW-SURFACE-BRIGHTNESS GALAXIES

Chris C. Hayward, Jimmy A. Irwin, Joel N. Bregman*

Astronomy Department
Dennison Building
University of Michigan
Ann Arbor, MI
48109

cchaywar@umich.edu, jairwin@umich.edu, jbregman@umich.edu

We have searched for the presence of Type Ia supernovae (SN Ia) in the local Universe using data collected from the nightly optical surveys of the Robotic Optical Transient Search Experiment (ROTSE) Telescope. It was hoped that SN Ia detected outside of known galaxies would act as an earmark for previously-unknown low-surface-brightness (LSB) galaxies or free-floating stars that would otherwise be very difficult to detect.

The ROTSE data allowed us to survey 19,000 square degrees at declinations north of -38 degrees, but we did not find a single unambiguously-detected SN Ia in a period of time covering roughly one year. Using known SN Ia rates in bright galaxies, we are able to set an upper limit on the optical luminosity density of LSBs in the local Universe. Assuming standard mass-to-light ratios, we find 68% confidence upper limits for LSBs of luminosity density <= 8.94 x 10^7 solar luminosities per cubic megaparsec, omega baryonic <= 0.00152, and omega dynamical <= 0.00447, and 95% confidence limits of optical luminosity density <= 2.35 x 10^8 solar luminosities per cubic megaparsec, omega baryonic <= 0.00400, and omega dynamical <= 0.0118. We conclude that LSBs and/or free-floating stars are not a major constituent of matter in the local Universe.